S28

A DBA's View of IMS Online Recovery Service

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Introduction

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Introduction

- This presentation was developed as a result of an ITSO Redbook residency

- The Redbook number is SG24-6112
  - ► Available at WWW.REDBOOKS.IBM.COM

Objectives

- **Why use IMS ORS?**

- **What the DBA needs to know**
  - ► **Provide DBA's a working view of IMS ORS components**
  - ► Changes in recovery options

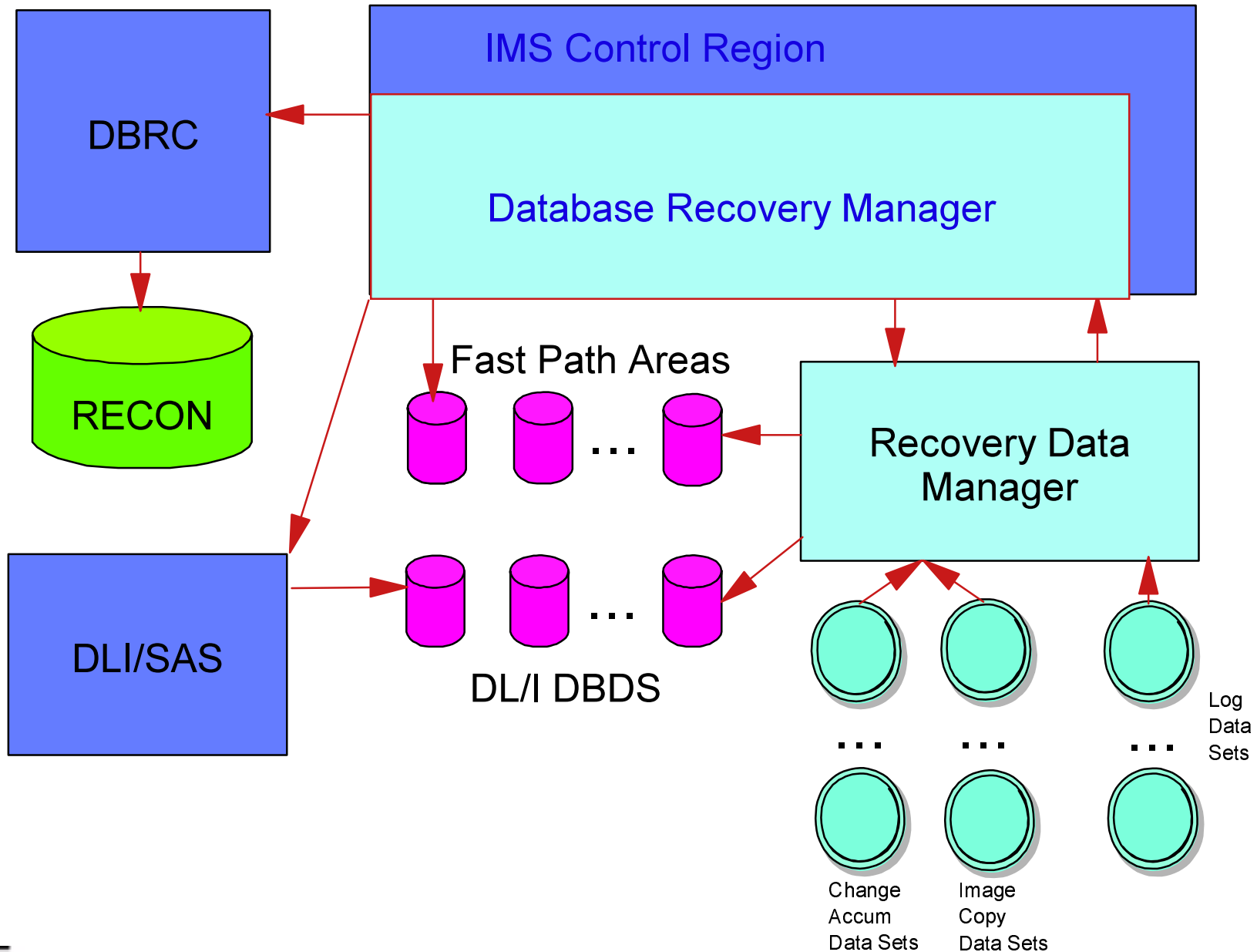- **Walk through the new interface to recoveries**

Why use IMS ORS?

- Remove need to run change accumlation
  - ► Data sharing environment

  - ► Concurrent update log data sets

- Read logs only once
  - ► Multiple DB recoveries

  - ► Don't have to merge logs or run last CA

Why use IMS ORS?

- Point-in-time recoveries
  - ► Recovery to any valid timestamp

  - ► Only committed updates applied

- Simplied recovery procedures
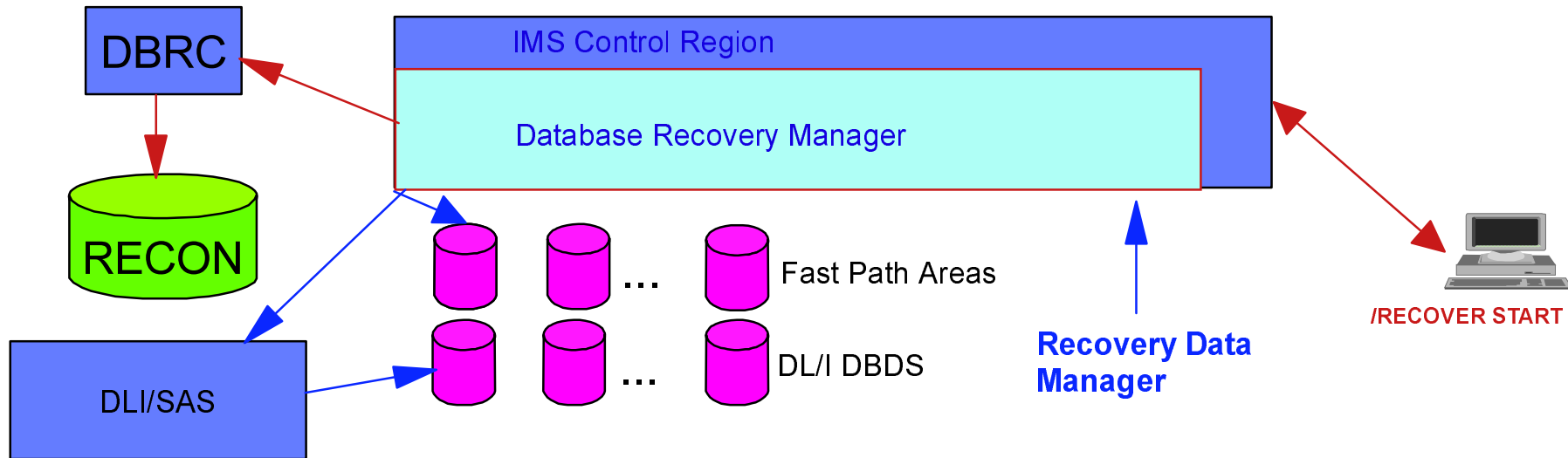 - ► IMS command interface

  - ► No JCL requirements

IMS ORS Components

DBRC

RECON

DLI/SAS

IMS Control Region

Database Recovery Manager

Fast Path Areas

DL/I DBDS

Recovery Data Manager

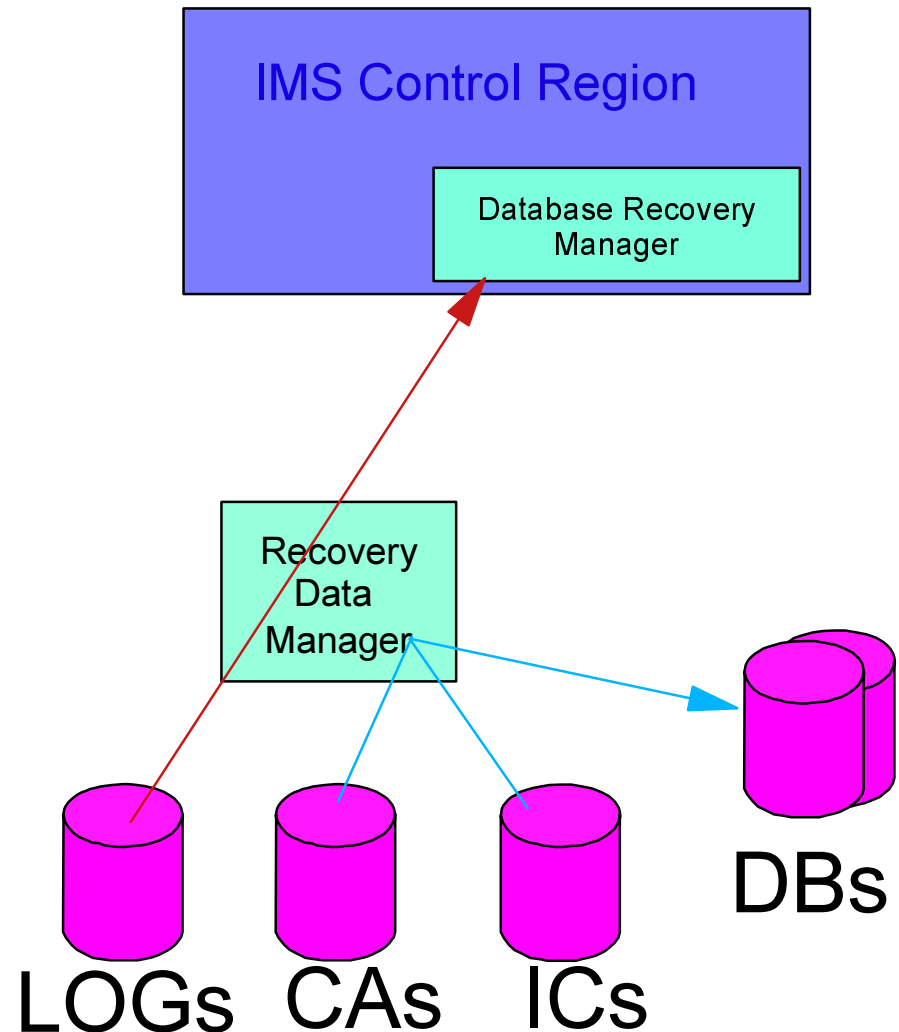Change Accum Data Sets

Image Copy Data Sets

Log Data Sets

Database Recovery Manager
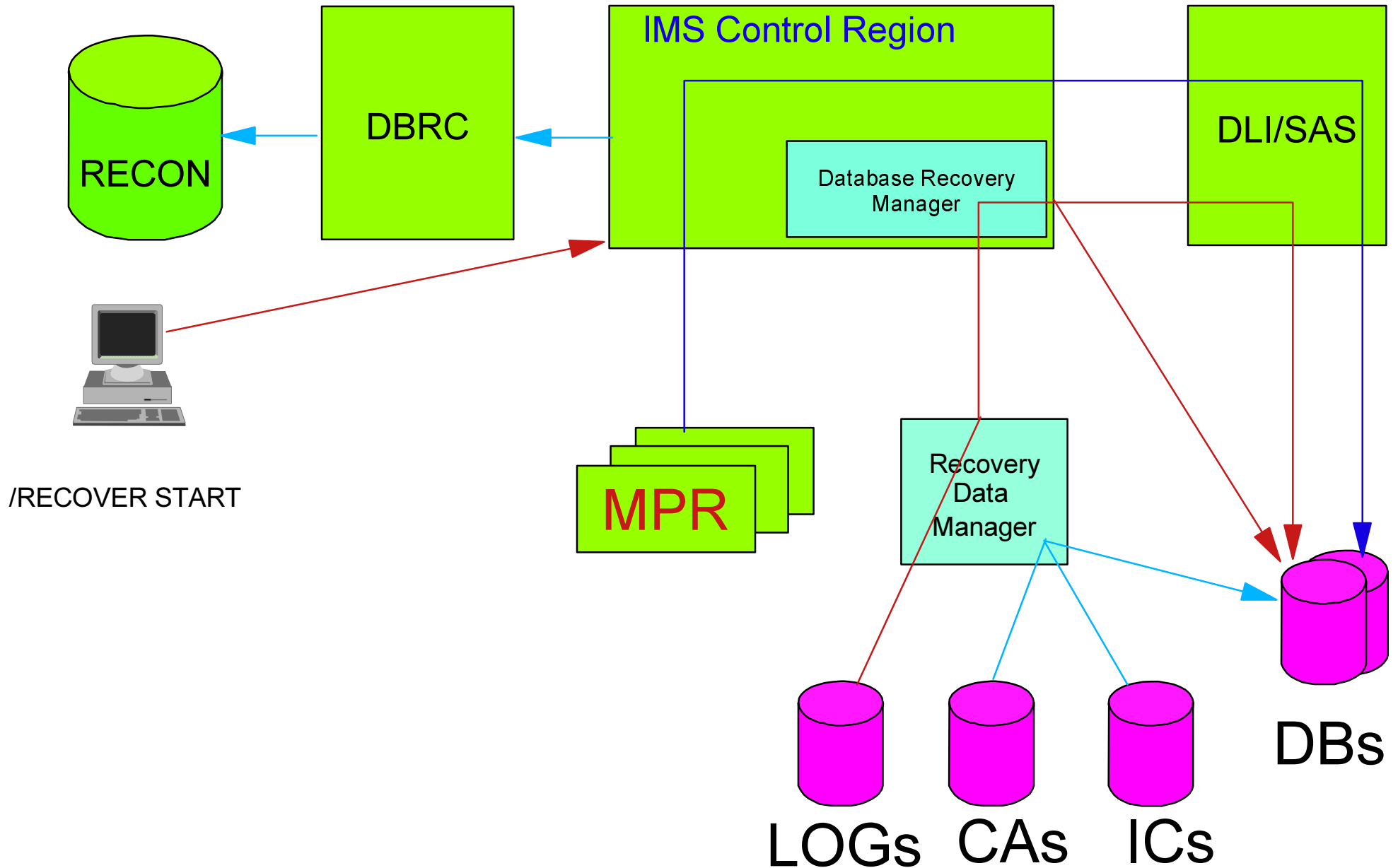

- IMS modules running in the Control region
- Driven by IMS command processor
- Ensures operational readiness of recovery
- Initiates Recovery Data Manager (RDM) address space
- Receives streams of log data from RDM
- Passes log streams to DLISAS for update processing
- Coordinates recovery termination

Recovery Data Manager

- **MVS address space**
  - Started on first /RECOVER command
  - Terminated by /REC TERM command
- **Function**
  - Reads IC data sets and restores database(s)
  - Reads and merges CA data sets onto database(s)
  - Merges log data into recovery stream and sends to DRM
    - RLDS if available
    - SLDS if RLDS in error
    - Can't read OLDS (can't start recovery with unarchived data)

IMS Control Region

Database Recovery Manager

Recovery Data Manager

LOGs   CAs   ICs   DBs

Operational IMS system with ORS running

RECON

DBRC

IMS Control Region

Database Recovery Manager

DLI/SAS

/RECOVER START

MPR

Recovery Data Manager

LOGs   CAs   ICs

DBs

ORS Only System

RECON

DBRC

IMS Control Region

Database Recovery Manager

DLI/SAS

/RECOVER START

Recovery Data Manager

LOGs   CAs   ICs

DBs
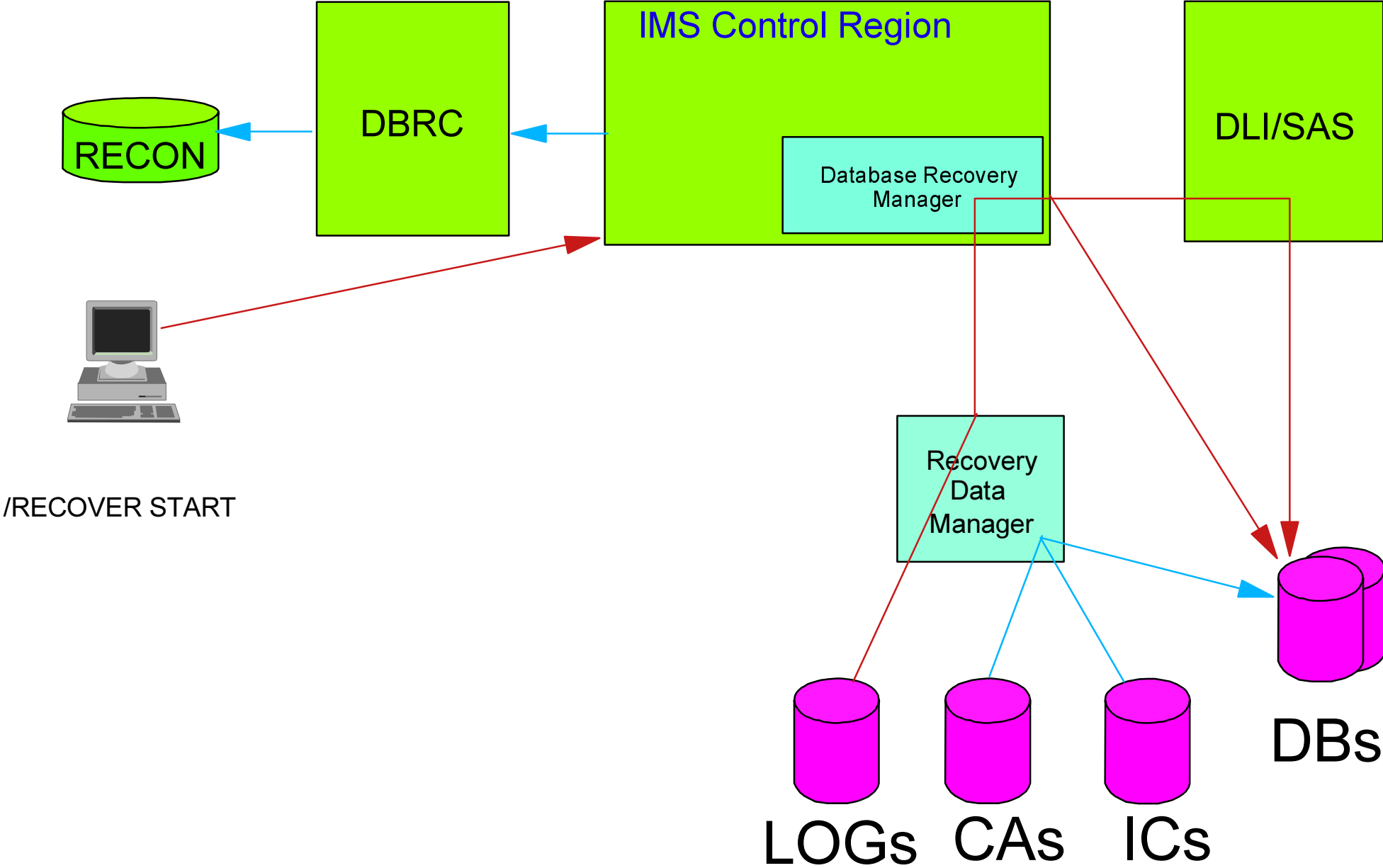
What the DBA needs to know

- **Recovery Data Manager parameters**
  - ► Number of concurrent read operations available
    - READNUM
    - This number is the total number of volumes (cartridge and DASD) which can be used at one time
      - stacked data sets count as 1 instance
    - Count includes IC, CA and log data sets
    - IC and CA applied directly to databases
    - Log data passed to Database Recovery Manager for updates

What the DBA needs to know

- Only one recovery can be STARTED in an IMS system
  - ► More then one recovery list can be built

  - ► Multiple IMS systems could run multiple recoveries concurrently (even in data sharing environment)

  - ► Any of the DBRC groups can be used to dynamically define databases to be recovered
    - – Recovery groups (RECOVGRP)
    - – Database dataset groups (DBDSGRP)
    - – Database groups (DBGRP)

What the DBA needs to know

- If using a stand alone IMS system to run IMS ORS
  - ► All databases must be defined via DATABASE macro commands in the IMS gen

  - ► RECONs should be shared with operational IMS system

  - ► Databases must be registered to DBRC

  - ► Databases must be offline from operational and stand alone IMS systems

What the DBA needs to know

- IMS ORS normally uses the RECON definitions to dynamally allocate devices
  - ► TAPEUNIT/DASDUNIT on RECON header record
  - ► Must be set to valid unit devices for this MVS system
  - ► INIT/CHANGE.RECON
  - ► Checks if RECON definitions match catalog and will use catalog information if it differs from RECON

What the DBA needs to know

- The data set allocation/atributes are outside the scope of IMS ORS
  - ► Data sets must already be allocated
  - ► IMS Version 7 support the VSAM REUSE option
    - – No longer do you have to delete/define VSAM clusters
  - ► OSAM allows IMS to overwrite data set
    - – Multi-volume data set support
  - ► To change any data set attributes
    - – Use traditional delete/define methods
    - – Use ALTER

Walk Through the Interface

- **IMS ORS is a JCL free recovery zone**
  - ► Recoveries are run in an IMS online region
  - ► No Utility JCL to code
  - ► No skelatal JCL to modify
- **IMS ORS is a Utility free zone**
  - ► No decisions on which utilities to use
  - ► No multiple job recoveries to control
- **IMS ORS is a single IMS command interface**
  - ► One command fits all
  - ► /RECOVER

Recovery Process

- Build a recovery list
  - ► Define which databases are to be recovered
- Display a recovery list (optional)
  - ► Check to ensure correct databases included
- Modify a recovery list (if required)
  - ► Add/remove databases as required
- Start a recovery
  - ► Begin the execution of the recovery
  - ► Modify a recovery in progress
- Check completed recovery

Build a Recovery List

- /RECOVER ADD command

/RECover ADD ─┬─────────────────────┬─┬─ OFFLINE ──┬─
              └─ RCVTOKEN token ─────┘ ├─ STAGLOBAL ─┤
                                       └─ STALOCAL ──┘

─┬─ DB ──── dbname ──────────────┬─┬─ USEDBDS ─┬─
 ├─ DBDS ──── dbname ddname ─────┤ └─ USEAREA ─┘
 ├─ AREA ──── areaname ──────────┤
 ├─ DATAGROUP ── group name ─────┤
 ├─ DBDSGRP ── group name ───────┤   ──► SMSOPT ── DELCAT ──
 ├─ CAGRP ── group name ─────────┤
 └─ RECOVGRP ── group name ──────┘

IBM.
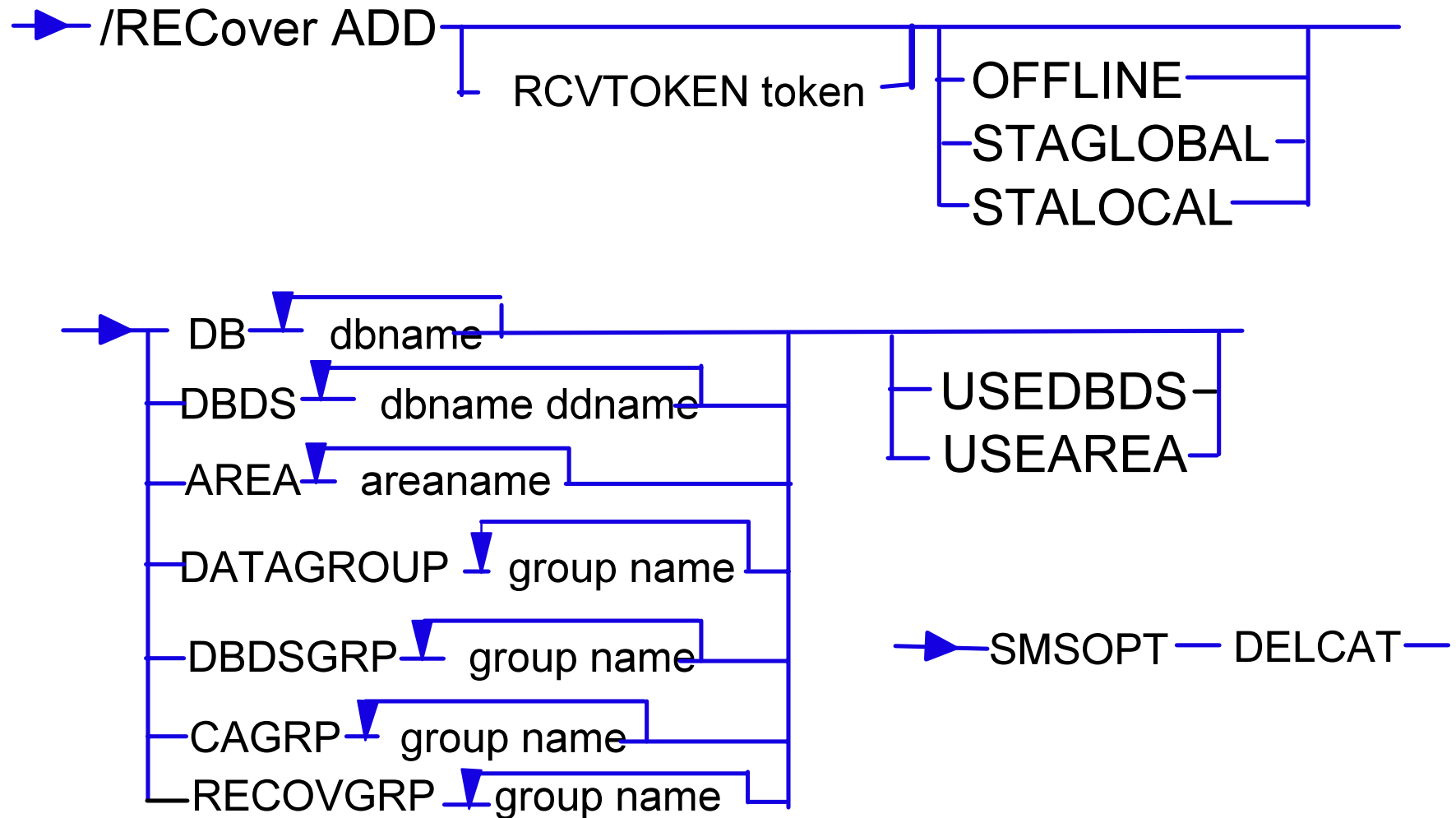
Build a Recovery List

```
    ──►── /RECover ADD ─┬──────────────────────────┬──
                        └── RCVTOKEN token ──┘
```

- If no token entered a default of DFSxxxxx is used, where xxxx is the next available number starting at 00001.

- If supplied and the list is already defined, then DB records will be added to the list.

- The list will be kept while this IMS system is active

- Many lists can be built but only one can be STARTED

Build a Recovery List

```
►──/RECover ADD──────────────────────────────────────────
                               ┌─OFFLINE───────┐
                               ├─STAGLOBAL─────┤
                               └─STALOCAL──────┘
```

- Start option to be used upon successful completion of the recovery
  - ► Leave offline - default

  - ► Start databases on local IMS system

  - ► Start databases on all sharing IMS systems

Build a Recovery List

```
──►──/RECover ADD ──────────────┬──────────────
                          ┌── USEDBDS ──┤
                          └── USEAREA ──┘
```
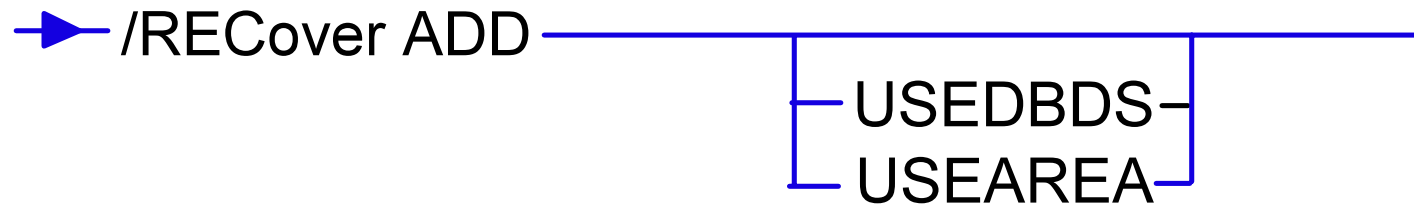
- Bypass the Image copy restore
  - ► USEDBDS/USEAREA

  - ► Only CA and Log data sets used

  - ► Applied to already existing database data sets

Build a Recovery List

/RECover ADD → DB — dbname

DBDS — dbname ddname

AREA — areaname

DATAGROUP — group name

DBDSGRP — group name

CAGRP — group name

RECOVGRP — group name
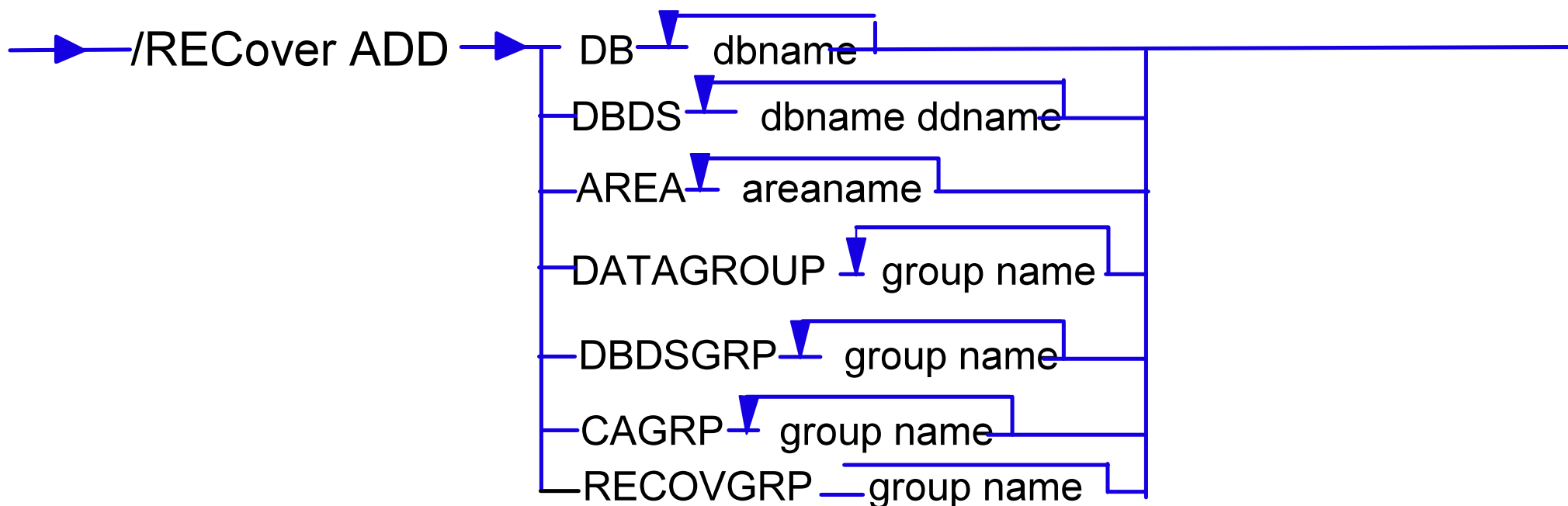
- Database data sets added
  - By name
    - DB
    - DBDS
    - AREA

- By RECON Group
  - DBDSGRP
  - DBGRP
  - CAGRP
  - RECOVGRP (new)

Build a Recovery List

──▶──/RECover ADD ──▶── SMSOPT──DELCAT ─────────

- ## SMS options (optional) passed for image copy restore
  - ► "Delete Catalog" is the only option supported at present
    - – Applies only to Image Copy 2
  - ► Passes DELETECATALOG SMS option on IC restore
  - ► Reformatted volume disaster
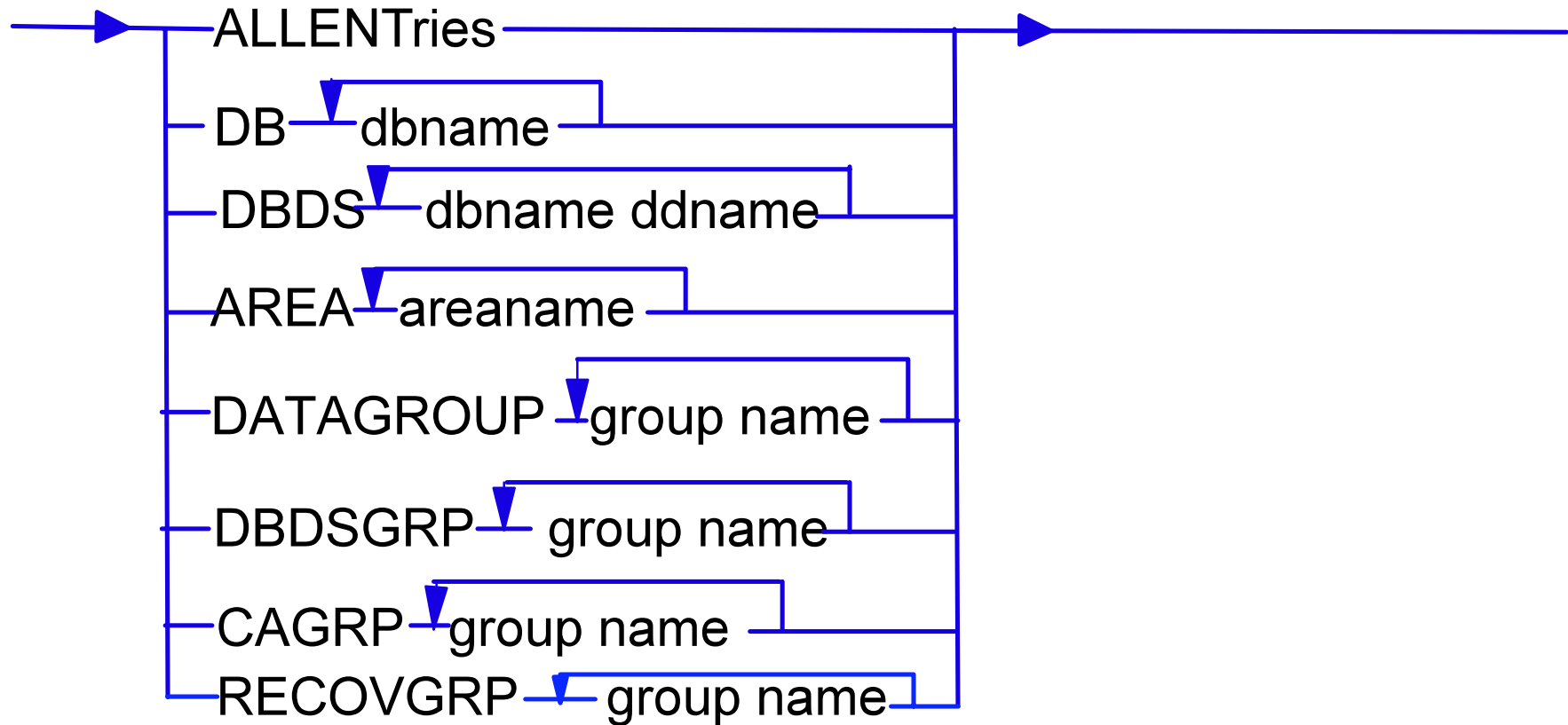
Build a Recovery List

- Recovery Group (RECOVGRP)
  - ► Group of databases which IMS ORS is to enforce recovery rules
    - – All databases

Display a Recovery List

- /DISPLAY RECOVERY RCVTOKEN token

  - ► DBDS in recovery list (alphabetically)

  - ► START option for each DBDS

  - ► STATUS

  - ► Authorization
    - If DB is currently authorized to subsystem
    - IMSID or Jobname

Modify a Recovery List

/RECover REMOVE ──────── RCVTOKEN─ token ──────►

```
──►─┬─ ALLENTries ─────────────────┬──►─
    │                              │
    ├─ DB ─┬─ dbname ─┐            │
    │      └──◄───────┘            │
    ├─ DBDS ─┬─ dbname ddname ─┐   │
    │        └──◄──────────────┘   │
    ├─ AREA ─┬─ areaname ─┐        │
    │        └──◄─────────┘        │
    ├─ DATAGROUP ─┬─ group name ─┐ │
    │             └──◄───────────┘ │
    ├─ DBDSGRP ─┬─ group name ─┐   │
    │           └──◄───────────┘   │
    ├─ CAGRP ─┬─ group name ─┐     │
    │         └──◄───────────┘     │
    └─ RECOVGRP ─┬─ group name ─┐  │
                 └──◄───────────┘
```
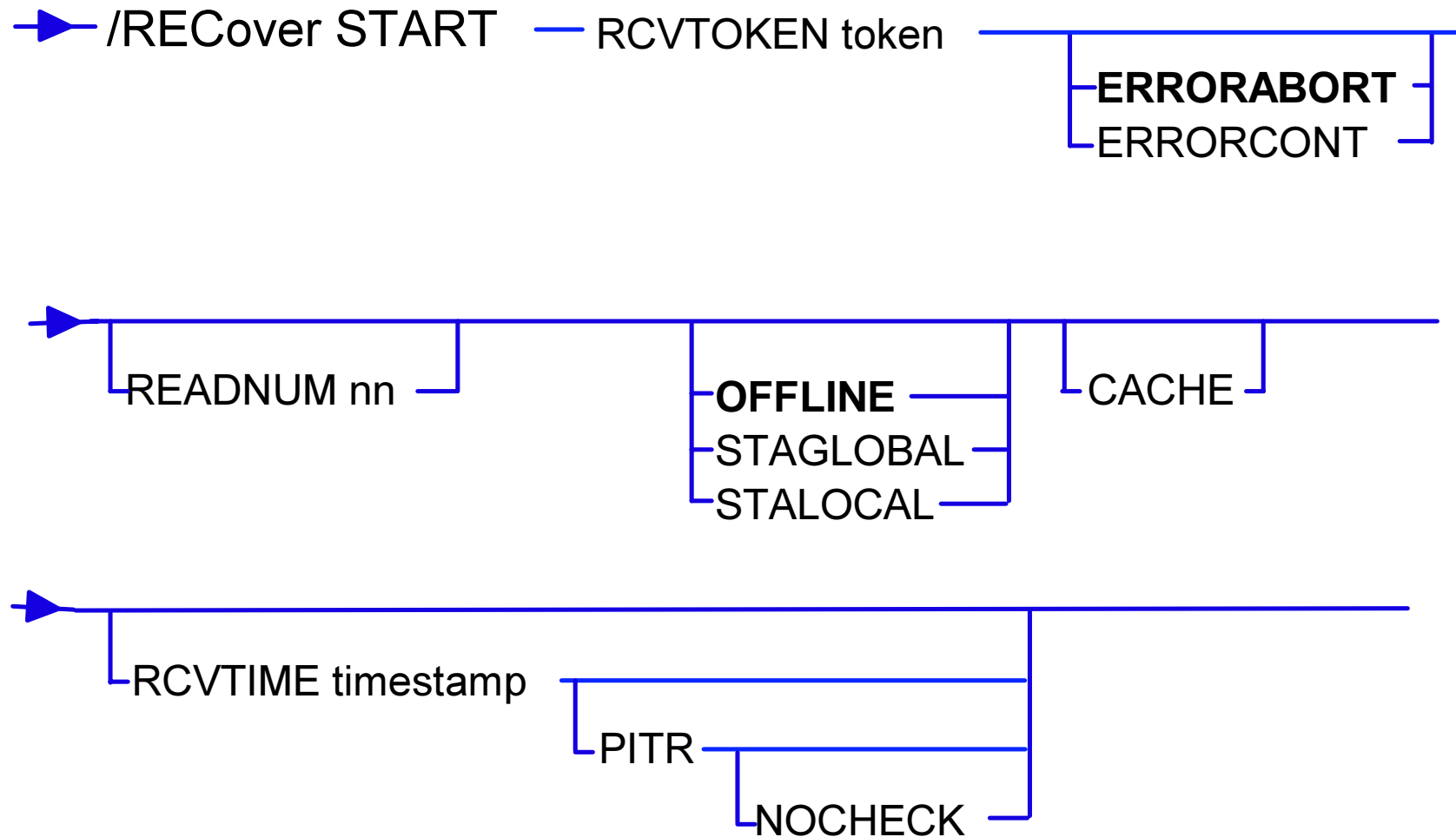
Modify a Recovery List

- Can't modify a STARTED list
- Remove DBDS just like adding them
  - ► Individual
  - ► Group
- ALLENT removes entire list and list is deleted
- Why use it?
  - ► Avoid creating only of groups
  - ► Add a group of databases
  - ► Remove one or two individual databases
  - ► Saves typing

Start a Recovery

- ## /RECOVER START command

```
►─── /RECover START ──── RCVTOKEN token ──────────────────────
                                              ┌─ ERRORABORT ─┐
                                              └─ ERRORCONT ──┘


►──┬──────────────────┬──────┬─ OFFLINE ──┬──┬─ CACHE ─┬──────
   └─ READNUM nn ──────┘      ├─ STAGLOBAL ┤  └─────────┘
                             └─ STALOCAL ──┘


►──┬───────────────────────┬──────────────────────────────────
   └─ RCVTIME timestamp ──┬─────────────────┬─
                          └─ PITR ──┬────────┘
                                    └─ NOCHECK ─┘
```

Start a Recovery

```
──►/RECover START ── RCVTOKEN token ──┬──────────┬──
                                      ├─ERRORABORT─┤
                                      └─ERRORCONT──┘
```

- ## Only one STARTED recovery per IMS system

- ## ERRORABORT
  - ► Stop recovery on first error
  - ► All databases left with RECOVERY NEEDED
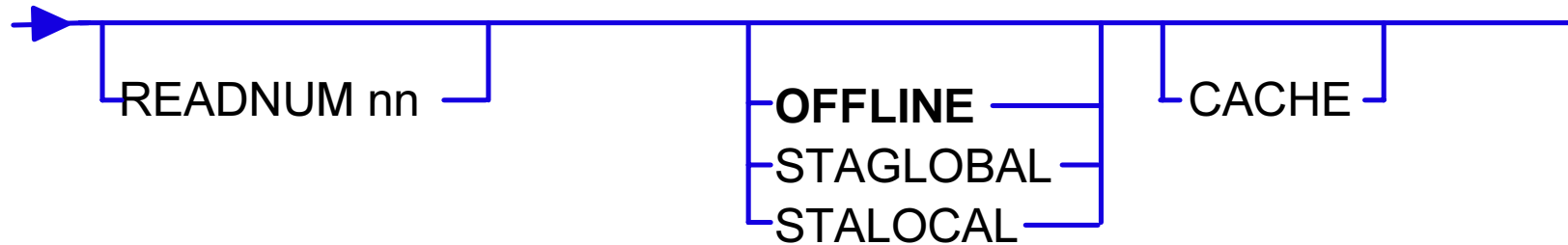 - ► List is kept

Start a Recovery

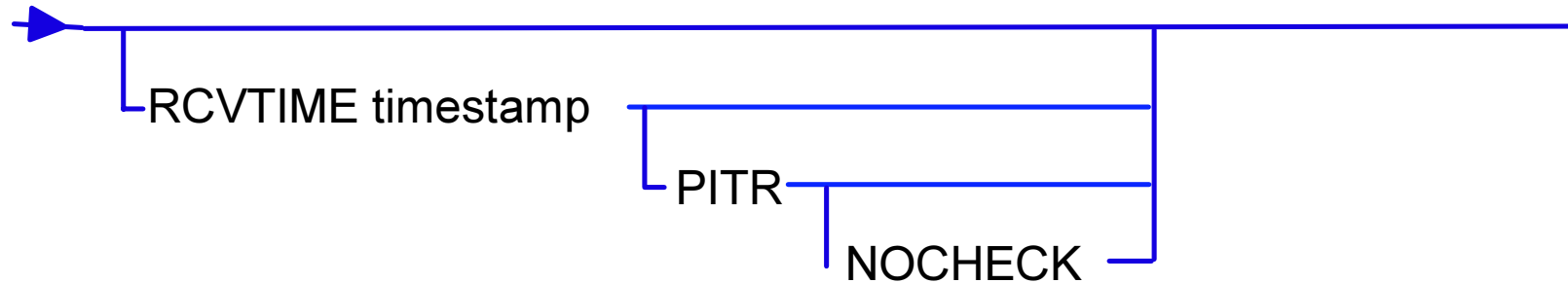/RECover START — RCVTOKEN token — **ERRORABORT** / ERRORCONT

- # ERRORCONT
  - ► Stop recovery for a database data set on error
  - ► Only database data sets not recovered left with RECOVERY NEEDED
  - ► List is not kept

Start a Recovery

```
──►──┬─────────────┬─────────┬──────────────┬───┬─────────┬────
     └─ READNUM nn ─┘         ├─ OFFLINE ────┤   └─ CACHE ─┘
                              ├─ STAGLOBAL ──┤
                              └─ STALOCAL ───┘
```

- ■ READNUM overrides system default
- ■ OFFLINE, STAGLOBAL, STALOCAL
  - ► Apply to entries not specified on REC ADD
- ■ CACHE
  - ► Preallocates log data sets during image copy restore
  - ► Migrates log data from tape to DASD for managed tape environments

Start a Recovery

```
──►─────────────────────────────────────────────────────────────────
     └─RCVTIME timestamp─┐
                         └─PITR─┐
                                └─NOCHECK─┘
```

- **Timestamp**
  - ► Any valid timestamp
  - ► Any valid format
- **PITR (Point In Time Recovery)**
  - ► If not present then timestamp must be valid DBRC timestamp
  - ► IMAGE COPY NEEDED flag set
- **NOCHECK**
  - ► Do check for consistency across a RECOVERY group

IMS ORS Example

- Recovery 2 HALDB databases and 2 partitioned Secondary index databases

- Commands issued from IMS terminal

Display Before Recovery

```
/DISPLAY DB DFXCSTP DFXBALY DFXZIPY DFXPRDP
```

DATABASE	TYPE	TOTAL	UNUSED	TOTAL	UNUSED	ACC	CONDITIONS
DFXCSTP	PHIDAM					UP	
CUST1	PART					UP	ALLOCS
CUST2	PART					UP	ALLOCS
CUST3	PART					UP	ALLOCS
CUST4	PART					UP	ALLOCS
CUST5	PART					UP	ALLOCS
CUST6	PART					UP	ALLOCS
DFXBALY	PSINDEX					UP	
BAL1	PART					UP	ALLOCS
DFXZIPY	PSINDEX					UP	
ZIP1	PART					UP	ALLOCS
DFXPRDP	PHDAM					UP	
PROD1	PART					UP	ALLOCS
PROD2	PART					UP	ALLOCS
00153/122652							

Build Recovery List

```
/RECOVER ADD RCVTOKEN APL1RECV DB DFXCSTP DFXBALY DFXZIPY DFXPRDP


DFS058I 17:20:13 RECOVER COMMAND IN PROGRESS

DFS4263I THE FOLLOWING ENTRIES ARE ADDED TO THE APL1RECV RECOVERY LIST:

DFS4265I BAL1 BAL1A
DFS4265I CUST1 CUST1A
DFS4265I CUST2 CUST2A
DFS4265I CUST3 CUST3A
DFS4265I CUST4 CUST4A

DFS4265I CUST5 CUST5A

DFS4265I CUST6 CUST6A
DFS4265I PROD1 PROD1A
DFS4265I PROD2 PROD2A
DFS4265I ZIP1 ZIP1A
```

Display Recovery List

```
/DISPLAY RECOVERY RCVTOKEN APL1RECV


**** RECOVERY LIST INFORMATION *********************
   TOKEN       STATUS        ERROR OPTION RECOVERY TYPE
   APL1RECV BEING BUILT N/A             N/A
    **** RECOVERY LIST ENTRY INFORMATION ***************
   DATABASE DATA SET    START OPTION  STATUS    AUTH SSID
   BAL1     BAL1A       OFFLINE       NORMAL    IMSR
   CUST1    CUST1A      OFFLINE       NORMAL    IMSR
   CUST2    CUST2A      OFFLINE       NORMAL    IMSR
   CUST3    CUST3A      OFFLINE       NORMAL    IMSR
   CUST4    CUST4A      OFFLINE       NORMAL    IMSR
   CUST5    CUST5A      OFFLINE       NORMAL    IMSR
   CUST6    CUST6A      OFFLINE       NORMAL    IMSR
   PROD1    PROD1A      OFFLINE       NORMAL    IMSR
   PROD2    PROD2A      OFFLINE       NORMAL    IMSR
   ZIP1     ZIP1A       OFFLINE       NORMAL    IMSR
   *00153/183333*
```

DBR Databases

```
/DBR DB CUST1 CUST2 CUST3 CUST4 CUST5 CUST6 BAL1 ZIP1 PROD1 PROD2



DFS058I 12:10:14 DBRECOVERY COMMAND IN PROGRESS

DFS0488I  DBR COMMAND COMPLETED. DBN= CUST1    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST2    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST3    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST3    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST4    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST5    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= CUST6    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= BAL1     RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= ZIP1     RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= PROD1    RC= 0
DFS0488I  DBR COMMAND COMPLETED. DBN= PROD2    RC= 0
```

Display After DBR

```
/DIS DB DFXCSTP DFXBALY DFXZIPY DFXPRDP
```

DATABASE	TYPE	TOTAL	UNUSED	TOTAL	UNUSED	ACC	CONDITIONS
DFXCSTP	PHIDAM					UP	
CUST1	PART					UP	STOPPED, NOTOPEN
CUST2	PART					UP	STOPPED, NOTOPEN
CUST3	PART					UP	STOPPED, NOTOPEN
CUST4	PART					UP	STOPPED, NOTOPEN
CUST5	PART					UP	STOPPED, NOTOPEN
CUST6	PART					UP	STOPPED, NOTOPEN
DFXBALY	PSINDEX					UP	
BAL1	PART					UP	STOPPED, NOTOPEN
DFXZIPY	PSINDEX					UP	
ZIP1	PART					UP	STOPPED, NOTOPEN
DFXPRDP	PHDAM					UP	
PROD1	PART					UP	STOPPED, NOTOPEN
PROD2	PART					UP	STOPPED, NOTOPEN

```
*00153/171142*
```

Start Recovery

```
/RECOVERY START RCVTOKEN APL1RECV

DFS058I 13:21:42 RECOVER COMMAND IN PROGRESS
DFS4264I RECOVERY STARTED FOR (APL1RECV,ERRORABORT):

DFS4265I BAL1 BAL1A
DFS4265I CUST1 CUST1A
DFS4265I CUST2 CUST2A
DFS4265I CUST3 CUST3A
DFS4265I CUST4 CUST4A
DFS4265I CUST5 CUST5A
DFS4265I CUST6 CUST6A
DFS4265I PROD1 PROD1A
DFS4265I PROD2 PROD2A
DFS4265I ZIP1 ZIP1A
```

Display of DBs During Recovery

```
/DIS DB CUST1 CUST2 CUST3 CUST4 CUST5 CUST6


DATABASE     TYPE    TOTAL UNUSED  TOTAL UNUSED ACC  CONDITIONS
DFXCSTP      PHIDAM                              UP
CUST1        PART                                UP   NOTOPEN, RECOVERY
DFXCSTP      PHIDAM                              UP
CUST2        PART                                UP   NOTOPEN, RECOVERY
DFXCSTP      PHIDAM                              UP
CUST3        PART                                UP   NOTOPEN, RECOVERY
DFXCSTP      PHIDAM                              UP
CUST4        PART                                UP   NOTOPEN, RECOVERY
DFXCSTP      PHIDAM                              UP
CUST5        PART                                UP   NOTOPEN, RECOVERY
DFXCSTP      PHIDAM                              UP
CUST6        PART                                UP   NOTOPEN, RECOVERY
```

Display of Rec List During Recovery

```
**** RECOVERY LIST INFORMATION *********************
  TOKEN     STATUS      ERROR OPTION RECOVERY TYPE
  APL1RECV STARTED     ERRORABORT    FULL
  **** RECOVERY PROGRESS INFORMATION *****************
  TOKEN     LAST PROCESSED          RCVTIME

  APL1RECV 0000.000 00:00:00.0    N/A
```

Recovery Completed

```
DFS4277I RECOVERY COMPLETE FOR:   BAL1      BAL1A
DFS4277I RECOVERY COMPLETE FOR:   CUST1     CUST1A
DFS4277I RECOVERY COMPLETE FOR:   CUST2     CUST2A
DFS4277I RECOVERY COMPLETE FOR:   CUST3     CUST3A
DFS4277I RECOVERY COMPLETE FOR:   CUST4     CUST4A
DFS4277I RECOVERY COMPLETE FOR:   CUST5     CUST5A
DFS4277I RECOVERY COMPLETE FOR:   CUST6     CUST6A
DFS4277I RECOVERY COMPLETE FOR:   PROD1     PROD1A
DFS4277I RECOVERY COMPLETE FOR:   PROD2     PROD2A
DFS4277I RECOVERY COMPLETE FOR:   ZIP1      ZIP1A

DFS4285I END OF RECOVERY FOR:  APL1RECV
```

Messages from RDM

```
DFS4222I IMAGE COPY RESTORE COMPLETE:   BAL1      BAL1A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST4     CUST4A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST1     CUST1A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST5     CUST5A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST2     CUST2A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST6     CUST6A
DFS4222I IMAGE COPY RESTORE COMPLETE:   CUST3     CUST3A
DFS4222I IMAGE COPY RESTORE COMPLETE:   ZIP1      ZIP1A
DFS4222I IMAGE COPY RESTORE COMPLETE:   PROD2     PROD2A
DFS4222I IMAGE COPY RESTORE COMPLETE:   PROD1     PROD1A

DFS4219I 00000000 RECORDS PROCESSED
```

➤ ORS messages are issued to the IMS MTO if recovery is initiated from IMS Version 8

Start Recovery while databases online

```
/RECOVERY START RCVTOKEN APL1RECV

 DFS058I 13:44:18 RECOVER COMMAND IN PROGRESS


 DFS4266I UNABLE TO RECOVER:  BAL1     BAL1A   , NOT OFFLINE



 DFS4267I RECOVERY NOT STARTED,  ERRORABORT SPECIFIED
```

Partially completed Recovery List

```
DFS4278I  UNABLE TO COMPLETE RECOVERY FOR:   BAL1     BAL1A IMSR
DFS4278I  UNABLE TO COMPLETE RECOVERY FOR:   CUST1    CUST1A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   CUST2     CUST2A IMSR
DFS4278I  UNABLE TO COMPLETE RECOVERY FOR:   CUST3     CUST3A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   CUST4     CUST4A IMSR
DFS4278I  UNABLE TO COMPLETE RECOVERY FOR:   CUST5     CUST5A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   CUST6     CUST6A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   PROD1     PROD1A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   PROD2     PROD2A IMSR
DFS4277I  RECOVERY COMPLETE FOR:   ZIP1      ZIP1A IMSR
DFS4285I  END OF RECOVERY FOR:   APL1RECV IMSR
```

Adding Non-Register Database

```
/RECOVER ADD RCVTOKEN APL2RECV DB DFXCLAP DFXSTUP


DFS4261I UNABLE TO ADD TO APL2RECV DATABASE DFXCLAP:NOT DEFINED IN RECON
```

RMLIST command example

```
/RMLIST DBRC='DB DBD(DFXSTUP)'


 LIST.DB DBD(DFXSTUP)
 -------------------------------------------------------------------
 DB
  DBD=DFXSTUP                                    DMB#=35        TYPE=IMS
  SHARE LEVEL=1                    GSGNAME=**NULL**      USID=0000000001
  AUTHORIZED USID=0000000000  RECEIVE USID=0000000000 HARD USID=0000000
  RECEIVE NEEDED USID=0000000000
  DBRCVGRP=APL2RECG
  FLAGS:                                COUNTERS:
     BACKOUT NEEDED         =OFF          RECOVERY NEEDED COUNT    =0
     READ ONLY              =OFF          IMAGE COPY NEEDED COUNT =0
     PROHIBIT AUTHORIZATION=OFF           AUTHORIZED SUBSYSTEMS    =0
     RECOVERABLE            =YES          HELD AUTHORIZATION STATE=0
                                         EEQE COUNT               =0
     TRACKING SUSPENDED     =NO          RECEIVE REQUIRED COUNT  =0
     OFR REQUIRED           =NO
```